

## **DETAILED ACTION**

### ***Status of Application***

Claims 2-12, 14, 16, 17, 20 and 21 are pending and presented for examination.

### ***Response to Arguments***

Applicant's arguments with respect to claims 2-12, 14, 16, 17, 20 and 21 have been considered but are moot in view of the new ground(s) of rejection.

### ***Claim Objections***

Claim 8 is objected to because of the following informalities: containing is spelled incorrectly. Appropriate correction is required.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

1. Claims 2, 3, 5, 7, 8, 10, 11, 16, 17 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vo-Dinh (“Development of a DNA biochip: Principle and Applications”) in view of Vo-Dinh et al. (U.S. Pat. No. 6197503, hereinafter referred to as US’503).

Regarding claims 2, 3, 5, 7, 8, 10, 11, 16, 17 and 21, Vo-Dinh teaches a method for immobilizing DNA on a surface of a semiconductor that includes a plurality of CMOS photodiodes (abstract, section 2.1, page 53 and section 2.3, page 53-54) comprising: applying a layer of hydrophobic, non-swelling polymer, such as polystyrene or nitrocellulose, to the surface of an integrated circuit semiconductor (2nd paragraph of section 2.3, page 54 and section 3.1, page 55); and immobilizing DNA on the surface of the layer of hydrophobic polymer by spotting (3rd paragraph of section 2.3, page 54) followed by covalently immobilization with the use of

UV light (2nd paragraph of section 2.3, page 54). Vo-Dinh teaches applying the polymer layer in defined regions of the semiconductor (2nd paragraph of section 2.3, page 54). Vo-Dinh fails to explicitly state that the integrated circuit is a silicon semiconductor.

However, it is well known that silicon is a semiconductive material used in integrated circuits. Furthermore, US'503 teaches a nearly identical photodiode array, which may be prepared from a silicon (an inorganic material) semiconductor (column 6, lines 5-10 and column 9, lines 1-23), which is to be utilized in a similar DNA biosensor application (abstract). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the application to fabricate Vo-Dinh's integrated circuit as a silicon semiconductor. One would have been motivated to make this modification as one of ordinary skill in the art at the time of the invention could have made this modification with a reasonable expectation of success (as silicon is conventionally utilized in these devices), and the predictable result of providing a DNA biochip on a silicon semiconductor integrated circuit.

2. Claims 4, 6, 12 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vo-Dinh in view of US'503 as applied to claim 8 above, and further in view of Hubbell et al. (U.S. PGPUB No. 2002/0128234).

Regarding claims 4, 6, 12 and 14, Vo-Dinh in view of US'503 teach all the limitations of claim 8, but fail to teach activating the polymer layer or imparting a charge to the polymer layer by oxygen plasma treatment. However, Hubbell teaches immobilizing biomolecules on the surface of a polymer that has been applied to the surface of a sensor chip (abstract and Figure

2B). Hubbell further teaches that the polymer may be polystyrene which can be modified by an oxygen plasma, thereby imparting a charge to the polymer surface to make it more amenable to grafting (0014). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Vo-Dinh in view of US'503's method by treating the polymer surface with an oxygen plasma to activate it for grafting with the DNA, as taught by Hubbell. One would have been motivated to make this modification as it would allow for the activation of the polystyrene thereby allowing for rapid functionalization of the polystyrene in the immobilization step.

3. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Vo-Dinh in view of US'503 as applied to claim 8 above, and further in view of Kimura et al. (U.S. PGPUB No. 2002/0018996).

Regarding claim 9, Vo-Dinh in view of US'503 teach all the limitations of claim 8, but fail to teach immobilizing the DNA on a polyimide polymer substrate. However, Kimura teaches that nucleic acids, such as DNA (0025) can be immobilized on polyimide substrates (0032-0035). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Vo-Dinh in view of US'503's method by utilizing polyimide as the polymer substrate for the DNA immobilization, as taught by Kimura. One would have been motivated to make this modification as it is simply the substitution of one known polymer substrate for DNA for another. Furthermore, one of ordinary skill in the art at the time of the invention could have made this substitution with a reasonable expectation of success (given that

Kimura is teaching the immobilization of nucleic acid, such as DNA, on the substrate), and the predictable result of providing a substrate for DNA immobilization to be combined with an integrated circuit.

4. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Vo-Dinh in view of US'503 as applied to claim 17 above, and further in view of Theil (U.S. Pat. No. 6325977).

Regarding claim 20, Vo-Dinh in view of US'503 teach all the limitations of claim 17, but fail to teach the inorganic material comprising a semiconducting oxide. However, Theil teaches an integrated circuit having photosensors fabricated utilizing CMOS technology (abstract). Theil further teaches these circuits having a semiconducting oxide layer (column 7, lines 21-28) upon which biomolecules are immobilized (see Figure 2). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to prepare the polymer layer on a semiconducting oxide layer as taught by Theil. One would have been motivated to make this modification as Theil teaches that this semiconducting oxide layer can help to optimize the amount of light detected by the sensor (column 7, lines 33-35).

### ***Conclusion***

Claims 2-12, 14, 16, 17, 20 and 21 are pending.

Claims 2-12, 14, 16, 17, 20 and 21 are rejected.

No claim is allowed.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ROBERT S. WALTERS JR whose telephone number is (571)270-5351. The examiner can normally be reached on Monday-Friday, 8:00am to 5:00pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Barr can be reached on (571)272-1414. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR

system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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